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For Calculation.

No.		Beginning.			Ending.			Real Length of the Path.	Radiant.	
		h	λ	φ	h	λ	φ	β	AR	Decl.
1		....	......	....	51.9	1° 26'.6 w	54° 56'.4	....	....	
2		95.1	0° 1'.4 e	55° 50'.1	102.4	0 32.0 e	55 26.4	55.6	153°	+22°.1
3		....	......	....	119.0	2 26.4 w	55 27.1	....	....	
4		152.5	1 36.6 e	57 29.2	92.6	1 5.4 e	57 5.1	82.4	40.2	+66.6
5	AO	166.0	2 6.0 e	57 43.9	82.2	0 39.0 e	57 8.7	139.0	40.3	+49.9
	AN	164.5	2 4.3 e	57 43.6	82.3	0 41.5 e	57 10.2	133.0	39.5	+50.3
	ON	163.0	2 2.0 e	57 42.5	82.2	0 39.7 e	57 9.1	132.8	39.8	+50.3
6		....	....	....	83.1	1 3.2 w	55 39.3	....	....	

h and β are expressed in kilometers; λ is longitude from Copenhagen; φ is north latitude; *h* is the altitude of the meteor above the Earth's surface.

ERRATA.

In the *Publications A. S. P.*, No. 89, p. 66, for *T U* read *R T* in the sketch as also in the text.

PLANETARY PHENOMENA FOR MARCH AND APRIL, 1907.

BY MALCOLM McNEILL.

PHASES OF THE MOON, PACIFIC TIME.

Last Quarter..	Mar. 7,	$12^h 42^m$ A.M.	Last Quarter..	Apr. 5,	$7^h 20^m$ A.M.
New Moon...	" 13,	10 5 P.M.	New Moon...	" 12,	11 6 A.M.
First Quarter.	" 21,	5 10 P.M.	First Quarter.	" 20,	12 38 P.M.
Full Moon...	" 29,	11 44 A.M.	Full Moon....	" 27,	10 5 P.M.

The Sun passes the vernal equinox and spring begins about 10 A.M., Pacific time, March 21st.

Mercury is an evening star at the beginning of March, setting about an hour and one half after sunset, and will be an easy object for a few days about that date on clear evenings. It comes to greatest east elongation on March 1st, 18° 10′. This is a much smaller greatest elongation than the average, as it comes less than three days after perihelion. The planet approaches the Sun quite rapidly after the first few days of the month, passing inferior conjunction on the night of March 17-18th and becoming a morning star. It then moves rapidly away from the Sun, reaching greatest west elongation on April 14th. Its apparent distance from the Sun will then be 27° 36′, which is fifty per cent greater than its distance at the time of greatest east elongation in March; but the conditions for visibility are not nearly as good, as *Mercury* is now 13° south of the Sun, and rises less than an hour before sunrise, so that it will be impossible to see it with the naked eye.

Venus is still a morning star, rising 2^h 20^m before sunrise on March 1st, 1^h 38^m on April 1st, and 1^h 20^m on April 30th. The planet passed greatest west elongation on February 8th, and is now nearing the Sun, but the main cause of the diminution of the interval between the rising of the planet and of the Sun is the southward motion of the planet relative to the Sun. *Venus* passes about 1° 39′ north of the vernal equinox on the afternoon of April 26th. At 7 A.M. April 21st, Pacific time, it is in very close conjunction with *Saturn,* passing 0° 38′ north of the latter.

Mars rises at 1^h 36^m A.M. on March 1st, at 12^h 50^m A.M. on April 1st, and at 11^h 52^m P.M. on April 30th. During the two-months period it moves 31° eastward and 2° southward, from *Scorpio* through the southern extremity of *Ophiuchus* into *Sagittarius,* and during the latter part of April is in the neighborhood of the "milk-dipper" group in the latter constellation, a little farther north. Its distance from the Earth diminishes from 121 millions of miles on March 1st to 70 millions on April 30th, and its brightness at the latter date is consequently about three times as great as it was at the former, rather more than a magnitude, as the brightness of stars is usually reckoned. From now on it will be a conspicuous object until some months after opposition.

Jupiter is in fine position for evening observation. On March 1st it sets a little before 3 A.M. and on April 30th at a little before 11:30 P.M. It is in the constellation *Gemini,* and moves about 7° nearly due eastward during the two months. It is in a region richer in bright stars than any other in the sky. *Castor and Pollux* are east of the planet, *Aldebaran* is west, and the bright stars of the *Orion* group, with *Canis major* and *Canis minor,* are to the south.

Saturn is an evening star on March 1st, but sets about half an hour after sunset, and is therefore too near the Sun for naked-eye observations. On the night of March 8-9th it passes conjunction with the Sun and becomes a morning star. The planet does not reach a great enough distance from the Sun to be seen in the morning twilight until well into April. At the end of the month it rises about an hour and three quarters before sunrise. It is in the constellation *Pisces,* and moves about 6° east and 3° north during the two months.

The phenomena displayed by *Saturn's* rings during 1907 will be of great interest to astronomers. The rings are so nearly edgewise to the Earth throughout the year that very little can be seen of them with a small telescope, but large telescopes may be able to show some new and interesting things. Since the autumn of 1891 both Sun and Earth have been above the plane of the rings, but on April 12th the Earth passes through this plane and from that time until July 25th the Earth and Sun are on opposite sides of the plane and the face turned toward us is the unilluminated face. On July 25th the plane of the rings passes through the Sun, and until October 4th both Sun and Earth are on the same side of the plane. On October 4th the Earth again passes through the plane, and for the remainder of the year the Earth and Sun are again on opposite sides. Early in 1908 the Earth again passes through the plane, and for the succeeding fifteen years the Earth and Sun are both below the plane. Questions as to the transparency and thickness of the rings may possibly be solved. The year 1907 affords the best opportunity for the study of these phenomena which we have had for many years. *Saturn* is in opposition in September, and the planet is fairly well placed for observation from the middle of April to the end of the year. In 1891 Sun and Earth were on opposite sides of the ring for only one month, and this period began only ten days after conjunction, so that the planet was too near the Sun for satisfactory observation.

Uranus rises shortly before 4 A.M. on March 1st and shortly before midnight on April 30th. It is still in *Sagittarius* north of the "milk-dipper."

Neptune is in *Gemini,* a few degrees east of *Jupiter.*

THE CAUSE OF EARTHQUAKES AND MOUNTAIN FORMATION.[1]

By T. J. J. See.

Soon after the great earthquake of April 18th, the writer entered upon a general examination of the cause of earthquakes, because the explanations put forth to account for that phenomenon seemed inadequate. The conclusions finally reached have been embodied in a memoir just published in the *Proceedings* of the American Philosophical Society at Philadelphia: they had also been given in a public address at Leland Stanford Jr. University, on November 15th. The principal results are the following:—

(1) Volcanic activity, earthquakes, mountain formation, the feeble attraction of mountains noted in geodesy, the formation of plateaus and islands, and the great sea-waves which frequently accompany violent earthquakes, are all due to one common cause,—namely, the development of steam within or just beneath the Earth's crust, chiefly by the secular leakage of the ocean-bottoms, which are subjected to fluid pressure of nearly one thousand atmospheres by the superincumbent depth of water.

(2) As the development of steam is general under the seas, the strain under the Earth's crust would find relief chiefly around the margins of the oceans. The Pacific Ocean not only has high mountains all around it, but the land is rising geologically, and seven eighths of the active volcanoes of the world surround this great ocean. No active volcano is over about one hundred miles from the ocean or other large body of water, while many are submarine, and volcanic islands are forming all the time. Of the vapors emitted by volcanoes 999 in 1000 parts is steam, which again confirms the dependence

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[1] Abstract of a lecture delivered before the A. S. P. in Hearst Hall, University of California, November 24, 1906.